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## THE SKULLS OF ARAEOSCELIS AND CASEA, PERMIAN REPTILES

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S. W. WILLISTON  
University of Chicago

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There are few Permian reptiles of greater interest at the present time than the peculiar one I briefly described in this journal<sup>1</sup> three years ago as *Araeoscelis gracilis*. At the time of the description the material in the University collections had not been prepared, and it was in the hope of acquiring additional material from the Craddock bone-bed near Seymour, Texas, whence the type specimens came, that I have delayed the publication of further details concerning the genus. Unfortunately the bone-bed seems to be exhausted, at least so far as *Araeoscelis* is concerned. The material of the University has now been worked up thoroughly by Mr. Miller, and is sufficient to reveal nearly all the details of the skeletal structure of this strange reptile, which in many ways departs widely from all other known reptiles of the Texas deposits. The object of the present paper is to describe briefly the structure of the skull for the information of others working on allied material. The full description of the skeleton, with illustrations, will be published later.

The skull, as shown in the accompanying figures, will not require a detailed description at this time. Suffice it to say that the structure of the temporal region is determined positively, save perhaps the precise union of the squamosal and jugal. The absence or vestigial condition of the lacrimal I am also confident about. The skull in life may have been slightly narrower than is shown in the figure; I do not think it could have been wider.

It has been suggested, especially by Huene, that *Araeoscelis* shows affinities with the lizards. The structure of the skull confirms this suggestion in a startling way. Really about all that seems necessary to convert *Araeoscelis* from a "theromorph" into a primitive squamate reptile is the reduction of the squamosal from

<sup>1</sup> *Journal of Geology*, XVIII, 587, October, 1910.

below and a greater mobility, or streptostyly, of the quadrate. Our specimens show a loose union of the squamosal with the quadrate, and it was the absence of the squamosal and postorbital in one specimen which induced me at first to believe that the whole temporal region was open. It is very possible that a like condition existed in *Varanosaurus* and that it may eventually be found to have a superior temporal vacuity only. I hope to decide this point by a study of additional material later.

I cannot be sure of the differentiation of the elements of the slender parietal arch, but I think it is very probable that it is formed

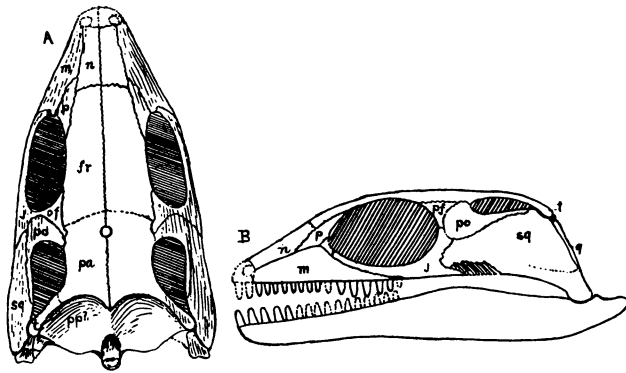


FIG. 1.—*Araeoscelis gracilis* Williston. *A*, skull, from above; *B*, the same from the side, both  $\frac{2}{3}$  natural size; *fr*, frontal; *j*, jugal; *m*, maxilla; *n*, nasal; *p*, prefrontal; *pa*, parietal; *pf*, postfrontal; *po*, postorbital; *pp*, supraoccipital and paroccipital; *q*, quadrate; *sq*, squamosal; *t*, tabulare.

more or less by the tabulare, as in the Lacertilia. The exclusion of the postorbital from the orbit seemed almost incredible, but I am convinced that such was the case in *Araeoscelis* by the agreement of several specimens. This exclusion would seem to mean that the single bone found here in the Lacertilia and Mosasauria is really the fused two bones, the postfronto-orbital.

Whether or not *Araeoscelis* was phylogenetically related to the Squamata scarcely a doubt can remain that the single arch in lizards was the result of the progressive loss from below of the squamosal, and not the loss of the lower arcade in some rhynchocephalian reptile, as has been generally believed. The Squamata undoubtedly arose from just such a type of skull as is shown in *Araeoscelis*.

Broom<sup>1</sup> has recently expressed his belief that *Araeoscelis* is closely allied to *Bolosaurus*, a genus hitherto placed among the Cotylosauria by Cope, Case, and Huene, the type of a distinct family, the Bolosauridae. He has described a new genus from among the material in the American Museum which had hitherto been confounded with *Bolosaurus*, but of whose distinction from *Araeoscelis* he was not sure. So far as his descriptions and figures go (aside from the restorations), there is nothing to distinguish

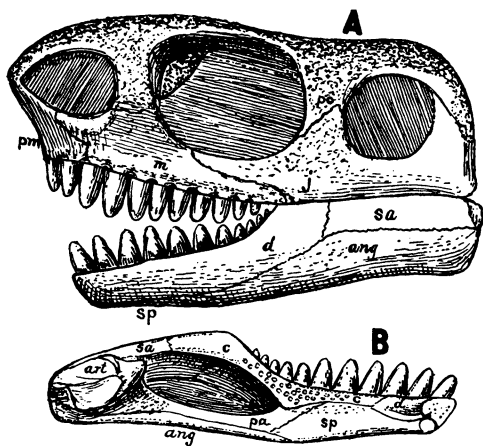


FIG. 2.—*Casea Broilii* Williston. A, skull from side; B, left mandible, both  $\frac{3}{4}$  natural size; art, articular; ang, angular; c, coronoid; d, dentary; m, maxilla; po, postorbital; pm, premaxilla; sp, splenial.

*Ophiodeirus* from *Araeoscelis*, save perhaps in the teeth, in which I think he is in error. The teeth of *Araeoscelis* are simple throughout, without accessory cusps, and they are distinctly thecodont. There are, however, some differences in the teeth among the material which I have referred to *Araeoscelis*. Typically there are fourteen, or possibly fifteen, teeth in the maxilla, of the size I have shown in the figure. Another specimen, consisting of the maxilla and mandible only, has at least sixteen teeth in the maxilla, all of a uniform small size; yet another skull has fourteen teeth, all of nearly uniform size. *Bolosaurus* comes from the Wichita beds, doubtless

<sup>1</sup> Bull. Amer. Mus. Nat. Hist., XXXII, 509, October, 1913.

of Carboniferous age; *Araeoscelis* from the Clear Fork, of Lower Permian age. Aside from the remarkable cuspidate and acrodont teeth, which are of more than generic importance, the structure of the skull in *Bolosaurus striatus*, as figured by Broom, separates the two genera into distinct orders.

A matter of more importance than the synonymy of *Ophiodeirus*, is the relationship of *Kadaliosaurus* Credner, from the Lower Permian of Germany. My attention to such possible relations was first called by a letter from Professor Jakolov written on the receipt of my paper containing the original description of *Araeoscelis*. He mentioned the fact that he had certain bones from Europe which seemed to be identical with those figured by me. A study of Credner's figures and description of *Kadaliosaurus* confirmed my belief of the affinity between the two genera, as I have already published. In showing our specimens to Dr. von Huene on his late visit to Chicago, I called his attention to these resemblances, in which he immediately concurred. Last April I had the privilege of

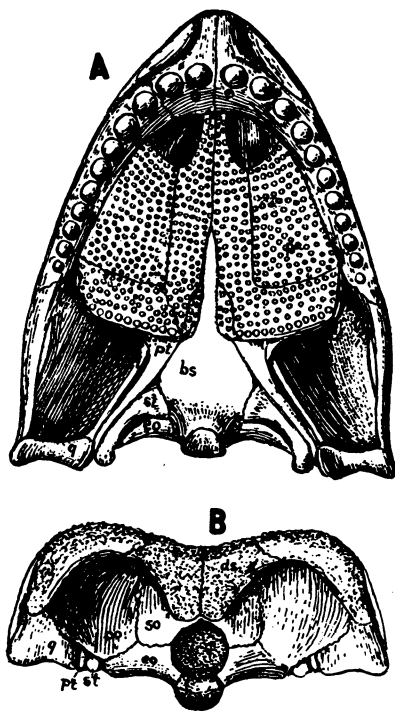


FIG. 3.—*Casea broilii*. A, skull from below; B, the same from behind; both  $\frac{2}{3}$  natural size: bs, basi sphenoid; eo, exoccipital; ds, dermosupraoccipital?; po, paroccipital; pt, pterygoid; pa, palatine; q, quadrate; st, stapes.

studying the type specimens of *Kadaliosaurus* and *Paleohatteria* in Leipzig, for which my thanks are due to Professor Stille and Dr. Henkel. The material of *Kadaliosaurus* is imperfect, but, so far as it goes, I could not distinguish the genus from *Araeoscelis*, save by the greater size of the specimen and the presence of ventral ribs, both dubious characters.

It would of course be premature to say that *Kadaliosaurus* and *Araeoscelis* are congeneric, but I cannot resist the belief that they are closely allied at the least. Possibly here, as so often elsewhere, the conclusions based on negative evidence are unreliable. It is not at all improbable; indeed I think it very probable, that the isolation of the American Permian fauna, in which I have concurred, will eventually be shown to be much less than has been supposed.

As a postscript I may mention, that, notwithstanding the general accuracy of Credner's descriptions, his interpretation of the scapula and coracoid of *Paleohatteria* is quite wrong. The genus has a normal pectoral girdle, with the coracoid closely united to the scapula, and probably with the usual supracoracoid foramen. The scapula is rather short, perhaps an indication of subaquatic habits. As I have stated elsewhere, I could find no indication of a supratemporal vacuity in *Paleohatteria*, and much evidence that there was none. I may also add, that from an examination of the specimens of *Haptodus* in the Paris museum, kindly granted me by M. Thevenin, I am confident that the two genera are distinct. *Paleohatteria* has a distinctly rugose skull, while that of *Haptodus* is quite smooth.